

Applicant : Brent J. Bos  
Serial No. : 10/614,454  
Page : 3

**Amendments to the Claims:**

This listing of claims will replace all prior versions and listings of claims in the present application:

87 (currently amended): A vehicular vision system comprising:

a wide angle lens group positionable on a portion of a vehicle for refracting a virtual image of an exterior view from the vehicle, thereby creating a wide angle refracted image, said wide angle lens group including an outer negative optic and an inner negative optic, said wide angle lens group comprising at least one of a polycarbonate and acrylic material;

a focusing lens group which receives said refracted image and focuses the refracted image onto an image plane;

an image capture device positioned on said image plane to receive the focused image from said focusing lens group, said wide angle lens group and said focusing lens group defining an optic path between an outer end of said wide angle lens group and said image capture device;

an image distortion correction process whereby an image captured by said vision system is processed to correct distortion therein, said image distortion correction process being at least partially provided by a plurality of refractive optics, said wide angle lens group including at least one wide angle diffractive element positioned along said optic path, said wide angle diffractive element correcting color focusing of the refracted virtual image, said wide angle diffractive element being on an outer surface of said inner negative optic; and

a display which displays a substantially non-distorted image of the scenic information, the non-distorted image being communicated from said image distortion process.

88 (original): The vehicular vision system of claim 87, wherein said focusing lens group includes a refractive and diffractive lens element positioned along said optic path.

89 (original): The vehicular vision system of claim 87, wherein said focusing lens group is constructed of one of polycarbonate and acrylic.

Applicant : Brent J. Bos  
Serial No. : 10/614,454  
Page : 4

90 (canceled).

91 (original): The vehicular vision system of claim 90, wherein said focusing lens group includes at least one diffractive element positioned along said optic path, said diffractive element correcting color focusing of the refracted image.

92 (canceled).

93 (currently amended): A The vehicular vision system of claim 92 comprising:

a wide angle lens group positionable on a portion of a vehicle for refracting a virtual image of an exterior view from the vehicle, thereby creating a wide angle refracted image, said wide angle lens group including an outer negative optic and an inner negative optic, said wide angle lens group comprising at least one of a polycarbonate and acrylic material;

a focusing lens group which receives said refracted image and focuses the refracted image onto an image plane;

an image capture device positioned on said image plane to receive the focused image from said focusing lens group, said wide angle lens group and said focusing lens group defining an optic path between an outer end of said wide angle lens group and said image capture device;

an image distortion correction process whereby an image captured by said vision system is processed to correct distortion therein, said image distortion correction process being at least partially provided by a plurality of refractive optics, said wide angle lens group including at least one wide angle diffractive element positioned along said optic path, said wide angle diffractive element correcting color focusing of the refracted virtual image; and

a display which displays a substantially non-distorted image of the scenic information, the non-distorted image being communicated from said image distortion process, wherein said wide angle diffractive element is on an outer surface of said inner negative optic, said wide angle diffractive element being defined by the equation:

Applicant : Brent J. Bos  
 Serial No. : 10/614,454  
 Page : 5

$$\Phi = A_1 \rho^2 + A_2 \rho^4$$

where  $\rho$  is a radial aperture coordinate divided by 1 mm;  $A_1$  is a constant within a range of approximately 15 to 55 and  $A_2$  is a constant within a range of approximately -0.01 to -0.5.

94 (original): The vehicular vision system of claim 93, wherein  $A_1$  is approximately 47.4149 and  $A_2$  is approximately -0.1463.

95 (original): The vehicular vision system of claim 93, wherein said outer surface of said inner negative optic has a radius of curvature in a range of approximately 20 mm to 60 mm.

96 (original): The vehicular vision system of claim 95, wherein said outer surface of said inner negative optic has a radius of curvature of approximately 35.3824 mm.

97 (original): The vehicular vision system of claim 95, wherein said inner negative optic has an inner aspheric surface opposite said outer wide angle diffractive element, said inner aspheric surface being defined by the following equation:

$$z = \frac{cy^2}{1 + \sqrt{1 - (1 + K)c^2y^2}}; \quad c = \frac{1}{r_{xy}};$$

where  $x$ ,  $y$  and  $z$  are coordinates on said inner aspheric surface along an  $x$ -axis, a  $y$ -axis and a  $z$ -axis, respectively,  $r_{xy}$  is a radius of curvature to each point on said inner aspheric surface corresponding to an  $x$  coordinate and a  $y$  coordinate, and  $K$  is a conic constant within a range of approximately -1 to -20.

98 (original): The vehicular vision system of claim 97, wherein  $K$  is approximately -13.3619.

99 (original): The vehicular vision system of claim 97, wherein said outer negative optic has an outer surface and an inner surface, said outer surface of said outer negative optic having a radius of curvature of approximately 40 mm to 700 mm, said inner surface of said outer

Applicant : Brent J. Bos  
Serial No. : 10/614,454  
Page : 6

negative optic having a radius of curvature of approximately 20 mm to 40 mm, said inner surface of said outer negative optic being on a side toward said inner negative optic.

100 (original): The vehicular vision system of claim 91, wherein said wide angle lens group includes at least one wide angle diffractive element positioned along said optic path, said wide angle diffractive element correcting color focusing on the refracted image.

101 (original): The vehicular vision system of claim 87, wherein said image distortion correction process is provided by said image capture device.

102 (original): The vehicular vision system of claim 101, wherein said image capture device is a CMOS imaging array including a non-uniform array of pixels, said non-uniform array having a coarse distribution of said pixels in portions corresponding to the refracted image where there is minimal distortion and a fine distribution of said pixels in portions corresponding to the refracted image where there is greater distortion, the refracted image being received by said non-uniform pixels and communicated to a uniform array on said display, said display thereby receiving and displaying a uniform, substantially non-distorted image to the operator of the vehicle.

103 (original): The vehicular vision system of claim 87, wherein said image distortion correction process is provided by electronic processing of the image received by said vision system.

104 (original): The vehicular vision system of claim 87, wherein said outer negative optic comprises crown glass and said inner negative optic comprises one of polycarbonate and acrylic.

105 (original): A vehicular vision system comprising:  
an image capture device having a field of view, said image capture device comprising a pixelated imaging array having a non-uniform array of pixels;

Applicant : Brent J. Bos  
Serial No. : 10/614,454  
Page : 7

a wide angle lens system disposed in front of said pixelated imaging array, said wide angle lens system including an outer negative optic and an inner negative optic;

at least one focusing lens disposed between said wide angle lens system and said pixelated imaging array, said wide angle lens system and said at least one focusing lens defining an optic path, said image capture device capturing an image exterior of the vehicle; and

a display, said display displaying a substantially non-distorted image in response to a signal output of said image capture device.

106 (original): The vehicular imaging system of claim 105, wherein said non-uniform array of pixels has a coarse distribution of pixels in at least one portion of said non-uniform array corresponding to at least one portion of the image where there is minimal distortion.

107 (original): The vehicular imaging system of claim 105, wherein said non-uniform array of pixels has a fine distribution of pixels in at least one portion of said non-uniform array corresponding to at least one portion of the image where there is greater distortion.

108 (original): The vehicular imaging system of claim 105, wherein said non-uniform array of pixels has a coarse distribution of pixels in at least one portion of said non-uniform array corresponding to at least one portion of the image where there is minimal distortion and a fine distribution of pixels in at least one portion of said non-uniform array corresponding to at least one portion of the image where there is greater distortion.

109 (original): The vehicular vision system of claim 105, wherein said image capture device comprises a CMOS imaging array.

110 (original): The vehicular vision system of claim 105, wherein said wide angle lens system comprises at least one of a polycarbonate and acrylic material.

111 (original): The vehicular vision system of claim 105, wherein said outer negative optic

Applicant : Brent J. Bos  
Serial No. : 10/614,454  
Page : 8

comprises crown glass and said inner negative optic comprises one of polycarbonate and acrylic.

112 (original): The vehicular vision system of claim 105, wherein said at least one focusing lens is constructed of one of polycarbonate and acrylic.

113 (original): The vehicular vision system of claim 105, wherein said at least one focusing lens includes a refractive lens element and a diffractive lens element.

114 (original): The vehicular vision system of claim 105, wherein said at least one focusing lens includes at least one diffractive element, said at least one diffractive element correcting color focusing of the image.

115 (original): The vehicular vision system of claim 114, wherein said wide angle lens system includes at least one wide angle diffractive element, said at least one wide angle diffractive element correcting color focusing of the image.

116 (original): The vehicular vision system of claim 105, wherein said wide angle lens system includes at least one wide angle diffractive element, said at least one wide angle diffractive element correcting color focusing of the image.

117 (currently amended): A the vehicular vision system of claim 116 comprising:

an image capture device having a field of view, said image capture device comprising a pixelated imaging array having a non-uniform array of pixels;

a wide angle lens system disposed in front of said pixelated imaging array, said wide angle lens system including an outer negative optic and an inner negative optic, said wide angle lens system including at least one wide angle diffractive element, said at least one wide angle diffractive element correcting color focusing of the image;

at least one focusing lens disposed between said wide angle lens system and said pixelated imaging array, said wide angle lens system and said at least one focusing lens

Applicant : Brent J. Bos  
 Serial No. : 10/614,454  
 Page : 9

defining an optic path, said image capture device capturing an image exterior of the vehicle;

and

a display, said display displaying a substantially non-distorted image in response to a signal output of said image capture device, wherein said wide angle diffractive element is on an outer surface of said inner negative optic, said wide angle diffractive element being defined by the equation:

$$\sigma = A_1 \rho^2 + A_2 \rho^4$$

where  $\rho$  is a radial aperture coordinate divided by 1 mm,  $A_1$  is a constant within a range of approximately 15 to 55 and  $A_2$  is a constant within a range of approximately -0.01 to -0.5.

118 (original): The vehicular vision system of claim 117, wherein said outer surface of said inner negative optic has a radius of curvature in a range of approximately 20 mm to 60 mm.

119 (original): The vehicular vision system of claim 118, wherein said inner negative optic has an inner aspheric surface opposite said outer wide angle diffractive element, said inner aspheric surface being defined by the following equation:

$$z = \frac{cy^2}{1 + \sqrt{1 - (1 + K)c^2y^2}}; \quad c = \frac{1}{r_{xy}};$$

where  $x$ ,  $y$  and  $z$  are coordinates on said inner aspheric surface along an  $x$ -axis, a  $y$ -axis and a  $z$ -axis, respectively,  $r_{xy}$  is a radius of curvature to each point on said inner aspheric surface corresponding to an  $x$  coordinate and a  $y$  coordinate, and  $K$  is a conic constant within a range of approximately -1 to -20.

120 (original): The vehicular vision system of claim 119, wherein said outer negative optic has an outer surface and an inner surface, said outer surface of said outer negative optic having a radius of curvature of approximately 40 mm to 700 mm, said inner surface of said outer negative optic having a radius of curvature of approximately 20 mm to 40 mm, said inner surface of said outer negative optic being on a side toward said inner negative optic.

Applicant : Brent J. Bos  
Serial No. : 10/614,454  
Page : 10

121 (original): A vehicular vision system comprising:

an image capture device having a field of view, said image capture device comprising a pixelated imaging array having a non-uniform array of pixels, said non-uniform array of pixels comprising a coarse distribution of pixels in at least one portion of said non-uniform array of pixels and a fine distribution of pixels in at least one other portion of said non-uniform array of pixels, said image capture device capturing an image exterior of the vehicle;

at least one lens disposed in front of said pixelated imaging array; and

a display, said display displaying a substantially non-distorted image of the exterior scene to the operator of the vehicle in response to a signal output of said image capture device.

122 (original): The vehicular imaging system of claim 121, wherein said non-uniform array of pixels has a coarse distribution of pixels in at least one portion of said non-uniform array of pixels corresponding to at least one portion of the image where there is minimal distortion.

123 (original): The vehicular imaging system of claim 121, wherein said non-uniform array of pixels has a fine distribution of pixels in at least one other portion of said non-uniform array of pixels corresponding to at least one portion the image where there is greater distortion.

124 (original): The vehicular imaging system of claim 121, wherein said non-uniform array of pixels has a coarse distribution of pixels in at least one portion of said non-uniform array of pixels corresponding to at least one portion of the image where there is minimal distortion and a fine distribution of pixels in at least one other portion of said non-uniform array of pixels corresponding to at least one portion the image where there is greater distortion.

125 (original): The vehicular vision system of claim 121, wherein said image capture device comprises a CMOS imaging array.

126 (original): The vehicular vision system of claim 121, wherein said at least one lens comprises at least one of a polycarbonate and acrylic material.



Applicant : Brent J. Bos  
Serial No. : 10/614,454  
Page : 11

127 (original): The vehicular vision system of claim 121, wherein said at least one lens comprises a wide angle lens group including an outer negative optic and an inner negative optic.

128 (original): The vehicular vision system of claim 127, wherein said outer negative optic comprises crown glass and said inner negative optic comprises one of polycarbonate and acrylic.

129 (original): The vehicular vision system of claim 127, wherein said wide angle lens group includes at least one wide angle diffractive element, said at least one wide angle diffractive element correcting color focusing of the image.

130 (currently amended): ~~The vehicular vision system of claim 129 comprising:~~

an image capture device having a field of view, said image capture device comprising a pixelated imaging array having a non-uniform array of pixels, said non-uniform array of pixels comprising a coarse distribution of pixels in at least one portion of said non-uniform array of pixels and a fine distribution of pixels in at least one other portion of said non-uniform array of pixels, said image capture device capturing an image exterior of the vehicle;

at least one lens disposed in front of said pixelated imaging array, said at least one lens comprising a wide angle lens group including an outer negative optic and an inner negative optic, said wide angle lens group including at least one wide angle diffractive element, said at least one wide angle diffractive element correcting color focusing of the image; and

a display, said display displaying a substantially non-distorted image of the exterior scene to the operator of the vehicle in response to a signal output of said image capture device, wherein said wide angle diffractive element is on an outer surface of said inner negative optic, said wide angle diffractive element being defined by the equation:

$$\sigma = A_1 \rho^2 + A_2 \rho^4$$

where  $\rho$  is a radial aperture coordinate divided by 1 mm,  $A_1$  is a constant within a range of approximately 15 to 55 and  $A_2$  is a constant within a range of approximately -0.01 to -0.5.

Applicant : Brent J. Bos  
Serial No. : 10/614,454  
Page : 12

131 (original): The vehicular vision system of claim 130, wherein said outer surface of said inner negative optic has a radius of curvature in a range of approximately 20 mm to 60 mm.

132 (original): The vehicular vision system of claim 131, wherein said inner negative optic has an inner aspheric surface opposite said outer wide angle diffractive element, said inner aspheric surface being defined by the following equation:

$$z = \frac{cy^2}{1 + \sqrt{1 - (1 + K)c^2y^2}}; \quad c = \frac{1}{r_{xy}};$$

where  $x$ ,  $y$  and  $z$  are coordinates on said inner aspheric surface along an  $x$ -axis, a  $y$ -axis and a  $z$ -axis, respectively,  $r_{xy}$  is a radius of curvature to each point on said inner aspheric surface corresponding to an  $x$  coordinate and a  $y$  coordinate, and  $K$  is a conic constant within a range of approximately -1 to -20.

133 (original): The vehicular vision system of claim 132, wherein said outer negative optic has an outer surface and an inner surface, said outer surface of said outer negative optic having a radius of curvature of approximately 40 mm to 700 mm, said inner surface of said outer negative optic having a radius of curvature of approximately 20 mm to 40 mm, said inner surface of said outer negative optic being on a side toward said inner negative optic.

134 (original): The vehicular vision system of claim 121, wherein said at least one lens includes at least one wide angle lens and at least one focusing lens, said at least one focusing lens being disposed between said at least one wide angle lens and said pixelated imaging array.

135 (original): The vehicular vision system of claim 134, wherein said at least one focusing lens is constructed of one of polycarbonate and acrylic.

136 (original): The vehicular vision system of claim 134, wherein said at least one focusing lens includes a refractive lens element and a diffractive lens element.

Applicant : Brent J. Bos  
Serial No. : 10/614,454  
Page : 13

137 (original): The vehicular vision system of claim 134, wherein said at least one focusing lens includes at least one diffractive element, said at least one diffractive element correcting color focusing of the image.

138 (original): The vehicular vision system of claim 137, wherein said at least one wide angle lens includes at least one wide angle diffractive element, said at least one wide angle diffractive element correcting color focusing on the image.